

VERIFICATION OF TRANSLATION

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do hereby declare that I have a thorough knowledge of the Japanese
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Japanese Patent Application No. 2002-274144

I further declare that all statements made herein of my own knowledge
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Declared at Tokyo, Japan

This 15th day of December, 2006

A handwritten signature in black ink, consisting of a large, stylized 'I' followed by a series of loops and a horizontal stroke at the end.

Ichitaro Ito

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[List of Filed Documents]

[Document]	Specification	1
[Document]	Drawing	1
[Document]	Abstract	1
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[Name of Document] SPECIFICATION

[Title of the Invention]

RADIO COMMUNICATION SYSTEM, MOBILE STATION AND BASE STATION

[Claim for a Patent]

[Claim 1] A radio communication system having a radio network controller, base stations and mobile stations, to perform multicast communication, wherein

the mobile station comprises a response signal transmitter configured to transmit a response signal including a group ID identifying a multicast group to the base station, the response signal responding to a control signal for the multicast group which the mobile station is joining in; and

the base station comprises a response signal transmitter configured to transmit at least one response signal to the radio network controller, the at least one response signal being selected from at least one response signal transmitted from mobile stations joining in the same multicast group.

[Claim 2] The radio communication system according to claim 1, wherein the base station further comprising a response signal holder configured to hold at least one response signal for a predetermined duration before transmitting at least one response signal to the radio network controller.

[Claim 3] The radio communication system according to claim 2, wherein the base station further comprising a detector configured to detect a first reception of the at least one response signal transmitted from the mobile stations; and wherein

the response signal holder holds the at least one response signal for a predetermined duration after the first reception of the at least one response signal.

[Claim 4] A mobile station supporting multicast communication, the mobile station comprising:

a response signal transmitter configured to transmit a response signal including a group ID identifying a multicast group to a base station, the response signal responding to a control signal for the multicast group which the mobile station is joining in.

[Claim 5] A base station supporting multicast communication, the base station comprising:

a response signal transmitter configured to transmit at least one response signal to the radio network controller, the at least one response signal responding to a control signal for a multicast group and being selected from at least one response signal transmitted from mobile stations joining in the same multicast group.

[Claim 6] The base station according to claim 5, further comprising a response signal holder configured to hold the at least one response signal for a predetermined duration before transmitting the at least one response signal to the radio network controller.

[Claim 7] The base station according to claim 6, further comprising a detector configured to detect a first reception of the at least one response signal transmitted from the mobile stations; and wherein

the response signal holder holds the at least one response signal for a predetermined

duration after the first reception of the at least one response signal.

[Detailed Description of the Invention]

[0001]

[Field of the Invention]

The present invention relates to a radio communication system performing multicast communication, a mobile station and a base station.

[0002]

[Prior Art]

As shown in FIG. 7, broadcast communication whereby a plurality of base stations 11 to 17 transmit common information to unspecified mobile stations 101 to 112 in predetermined areas is known in a conventional radio communication system. (For example, refer to the non-patent literature 1)

[0003] As shown in FIG. 8, multicast communication whereby a plurality of base stations 11 to 17 transmit common information to specific mobile stations joining in (belonging to) a specific group is known in a conventional radio communication system. (For example, refer to the non-patent literature 2)

[0004]

[Non-Patent Literature 1]

3rd Generation Partnership Project Technical Specification, Group Terminals, 23.041 Technical realization of Cell Broadcast Service (CBS), October, 2000

[Non-Patent Literature 2]

3rd Generation Partnership Project Technical Specification, Group Radio Access Network, 25.324 Broadcast/Multicast Control BMC, December, 2000

[0005]

[Problems to be Solved by the Invention]

However, there is a problem in that a plurality of mobile stations joining in a multicast group receive a controls signal for the multicast group at approximately the same time, and a plurality of response signals are transmitted to the radio network controller at approximately the same time, so that the load on receiving controlling and processing of the radio network controller is increased as the number of response signals increases in the conventional multicast communication.

[0006]

In viewing of the foregoing, it is an object of the present invention to provide a radio communication system which can reduce the load on the radio network controller during the multicast communication, a mobile station and a base station which can be used in the above radio communication system.

[0007]

[Means for Solving the Problems]

A first aspect of the present invention is summarized as a radio communication system having a radio network controller, base stations and mobile stations, to perform multicast communication.

The mobile station comprises a response signal transmitter configured to transmit a response signal including a group ID identifying a multicast group to the base station. The response signal responds to a control signal for the multicast group which the mobile station is joining in.

The base station comprises a response signal transmitter configured to transmit at least one response signal to the radio network controller. The at least one response signal is selected from at least one response signal transmitted from mobile stations joining in the same multicast group.

[0008] In the first aspect, the base station may further comprises the response signal holder configured to hold the at least one response signal for a predetermined duration (for example, a random duration) before transmitting the at least one response signal to the radio network controller.

[0009] Further, in the first aspect, the base station may comprises the detector configured to detect a first reception of the at least one response signal transmitted from the mobile stations, and the response signal holder holds the at least one response signal for a predetermined duration after the first reception of the at least one response signal.

[0010] A second aspect of the present invention is summarized as a mobile station supporting multicast communication. The mobile station comprises a response signal transmitter configured to transmit a response signal including a group ID identifying a multicast group to a base station. The response signal responds to a control signal for the multicast group which the mobile station is joining in.

[0011] A third aspect of the present invention is summarized as a base station supporting multicast communication. The base station comprises a response signal transmitter configured to transmit at least one response signal to the radio network controller. The at least one response signal responds to a control signal for a multicast group, and is selected from at least one response signal transmitted from mobile stations joining in the same multicast group.

[0012] In the third aspect, the base station may further comprise a response signal holder configured to hold the at least one response signal for a predetermined duration before transmitting the at least one response signal to the radio network controller.

[0013] In the third aspect, the base station may further comprise a detector configured to detect a first reception of the at least one response signal transmitted from the mobile stations. The response signal holder may hold the at least one response signal for a predetermined duration after the first reception of the at least one response signal.

[0014]

[Detailed Description of the Invention]

<A configuration of a radio communication system according to a first embodiment of the present invention>

FIG. 1 shows the entire configuration of a radio communication system according to a first embodiment of the present invention.

[0015] As shown in FIG. 1, the radio communication system according to the embodiment comprises four base stations 10, 20, 30 and 40 under a radio network controller 50.

In the radio communication system according to the embodiment, the base station 10 manages mobile stations 11 to 13, the base station 20 manages mobile stations 21 and 22, the base station 30 manages mobile stations 31 and 32, and the base station 40 manages mobile stations 41 to 43.

[0016] The mobile stations 11, 12, 21, 41, 42 and 43 join in the same multicast group A in the embodiment.

[0017] FIG. 2 shows a functional block diagram of the mobile station used in the radio communication system according to the embodiment. Functions of a plurality of mobile stations 11 to 43 are basically the same, so that the function of the mobile station 11 will be explained as follows.

[0018] As shown in FIG. 2, the mobile station 11 is configured with a control signal receiver 11a, a response signal transmitter 11b and a response signal creator 11c. The mobile station 11 can support multicast communication.

[0019] The control signal receiver 11a is configured to receive a control signal for the multicast group A. The control signal for the multicast group A is transmitted from the base station 10. The response signal creator 11c is configured to create a response signal to the control signal for the multicast group A. The response signal includes a group ID identifying a multicast group. The response signal transmitter 11b is configured to transmit the response signal to the base station 10 after holding the response signal.

[0020] According to the first embodiment, the response signal transmitter 11b and the response signal creator 11c comprises the response signal transmitter configured to transmit the response signal including a group ID identifying a multicast group A to the base station 10, for the multicast group which the mobile 11 station is joining in.

[0021] FIG. 3 shows a functional block diagram of the base station used in the radio communication system according to the embodiment. Functions of a plurality of base stations 10 to 40 are basically the same, so that the function of the base station 10 will be explained as follows.

[0022] As shown in FIG. 3, the base station 10 is configured with a mobile station signal receiver 10a, a control signal receiver 10b, a multicast group identifier 10c, a response signal creator 10d and a transmitter 10e.

[0023] The mobile station signal receiver 10a is configured to receive at least one response signal from a plurality of mobile stations 11 to 13.

The control signal receiver 10b is configured to receive a control signal for a multicast group from the radio network controller 50.

The mobile station signal receiver 10a and the control signal receiver 10b may be

configured with the same unit.

[0024] The multicast group identifier 10c is configured to identify whether the received response signal is transmitted from the mobile station joining in the same multicast group.

[0025] The response signal creator 10d is configured to create at least one response signal to be transmitted to the radio network controller 50, by extracting at least one response signal from at least one response signal transmitted from the mobile stations.

The response signal creator 10d may create at least one response signal to be transmitted to the radio network controller 50, by changing a format of the at least one response signal after extracting the at least one response signal from at least one response signal transmitted from the mobile stations.

[0026] The transmitter 10e is configured to transmit the control signal for the multicast group to the mobile station.

The transmitter 10e is configured to transmit the at least one response signal created by the response signal creator 10d to the radio network controller 50.

The transmitter 10e can transmit the control signal to the mobile stations after the expiration of a predetermined duration (for example, a random duration). The predetermined durations set up in each base station can be different.

[0027] In the first embodiment, the multicast group identifier 10c, the response signal creator 10d and the transmitter 10e comprises the response signal transmitter configured to transmit the response signal to the radio network controller 50, one or a predetermined number of the response signal transmitted from the mobile station 11, 12, 21, 41, 42 and 43 joining in the same multicast group.

[0028] Referring to FIG. 4, the operation whereby the radio network controller 50 performs a predetermined processing (for example, a service notice processing) on the mobile stations 11, 12, 21, 41, 42, 43 joining in the multicast group A in the radio communication system according to the embodiment will be described.

[0029] In step 1001, the radio network controller 50 transmits a control signal such as a service notice signal and an authentication signal to three base stations 10, 20 and 40.

[0030] In step 1002, each of the base stations 10, 20, (30) and 40 receives the control signal transmitted from the radio network controller 50. The control signals transmitted by each of the base stations 10, 20 and 40 reach the mobile stations 11, 12, 21, 41, 42 and 43 joining in the multicast group A under the base stations 10, 20 and 40.

[0031] In step 1003, each of the mobile stations 11, 12, 21, 41, 42 and 43 creates a response signal including a group ID. It is thus possible to identify that each of the mobile stations 11, 12, 21, 41, 42 and 43 is joining in the multicast group A with the group ID. Each of the mobile stations 11, 12, 21, 41, 42 and 43 respectively transmits the created response signal to the base stations 10, 20 and 40.

[0032] In step 1004, each of the base stations 10, 20 and 40 receives at least one response signal from each of the mobile stations 11, 12, 21, 41, 42 and 43, and identifies whether each of the response signals is transmitted from mobile stations joining in the same multicast group or not.

In this embodiment, each of the base stations 10, 20 and 40 identifies whether each of

the response signals is transmitted from mobile stations joining in the multicast group A or not.

[0033] As a result, the base station 10 receives two response signals from the mobile stations 11 and 12 joining in the multicast group A. The base station 20 receives one response signal from the mobile stations 21 joining in the multicast group A. The base station 30 receives three response signals from the mobile stations 41, 42 and 43 joining in the multicast group A. In the base station 10, 20 and 40, six response signals are detected in total. The base station 30 does not receive any response signal from mobile stations 41, 42 and 43 joining in the multicast group A.

[0034] Next, each of the base stations 10, 20 and 40 selects at least one response signal from at least one received response signal, and transmits the at least one selected response signal to the radio network controller 50.

[0035] In step 1005, the radio network controller 50 transmits service data to the base stations 10, 20 and 40 in accordance with the at least one response signal transmitted from each of the mobile stations 11, 21 and 41. In step 1006, each of the base stations 10, 20 and 40 transmits the received service data to each of the mobile stations 11, 12, 21, 41, 42 and 43.

[0036] The radio communication system according to the first embodiment can reduce the load on the receiving processing and controlling performed by the radio network controller 50, by transmitting a signal merging a plurality of response signals (common information) into one (or a predetermined number) to the radio network controller 50, when control signals for a multicast group are received in a plurality of mobile stations at approximately the same time like multicast communication or broadcast communication, and the response signals increase.

[0037]

[Modification 1]

The present invention is not limited to the first embodiment, and can be applied to a radio communication system which further comprises a response signal holder 10f as shown in FIG. 5.

[0038] The response signal holder 10f is configured to hold the at least one response signal for a predetermined duration (for example, a random duration) before transmitting the at least one response signal to the radio network controller 50.

[0039] The response signal holder 10f generates the response signal transmitting to the radio network controller 50 in accordance with the response signal held in the response signal holder 10 for a random duration.

In step 1006, each of the base stations 10, 20 and 40 transmits the received service data to each of the mobile stations 11, 12, 21, 41, 42 and 43.

[0040]

[Modification 2]

The present invention is not limited to the above embodiments, and can be applied to a radio communication system which further comprises a response signal holder 10f and an initial response detector 10g as shown in FIG. 6.

[0041] The initial response detector 10g is configured to detect a first reception of at least one

response signal received from each of the mobile stations 11, 12, 21, 41, 42 and 43 joining in the multicast group A. In the embodiment, the initial response detector 10g comprises the detector configured to detect the first reception of the response signal transmitted from the mobile terminal.

[0042] The response signal holder 10f holds the at least one received response signal for a predetermined duration (for example, a random duration) after the first reception of the at least one response signal.

The response signal creator 10d creates, in accordance with the at least one response signal which is being held for the random duration by the response signal holder 10f, at least one response signal to be transmitted to the radio network controller 50.

[0043]

[Effects of the Invention]

As described above, the present invention can provide a base station, a mobile station, and a base station used in a radio communication system which can reduce the load on the radio network controller during the multicast communication.

[Brief Description of the Drawings]

[FIG. 1] FIG. 1 is a diagram showing the entire configuration of a radio communication system according to an embodiment of the present invention.

[FIG. 2] FIG. 2 is a functional block diagram of a mobile station in the radio communication system according to an embodiment of the present invention.

[FIG. 3] FIG. 3 is a functional block diagram of a base station in the radio communication system according to an embodiment of the present invention.

[FIG. 4] FIG. 4 is a sequence diagram illustrating the operation of the radio communication system according to an embodiment of the present invention.

[FIG. 5] FIG. 5 is a functional block diagram of a base station in the radio communication system according to an embodiment of the present invention.

[FIG. 6] FIG. 6 is a functional block diagram of a base station in the radio communication system according to an embodiment of the present invention.

[FIG. 7] FIG. 7 is a diagram for explaining broadcast communication according to the prior art.

[FIG. 8] FIG. 8 is a diagram for explaining multicast communication according to the prior art.

[Description of the Reference Numerals]

10,20,30,40...base station

11,12,13,21,22,31,32,41,42,43...mobile station

50...radio network controller

[Name of Document] ABSTRACT

[Abstract]

[Object]

The object of the present invention is to provide a radio communication system which can reduce the load on a radio network controller 50 during multicast communication.

[Solving Means]

The present invention relates to the radio communication system having a radio network controller 50, base stations 10 to 40 and mobile stations 11 to 43, to perform multicast communication. The mobile station 11 comprises a response signal transmitter 11b and 11c configured to transmit a response signal including a group ID identifying a multicast group A to the base station 10. The base station 10 comprises a response signal transmitter 10c, 10d and 10e configured to transmit at least one response signal to the radio network controller 50.

[Selected Figure] FIG. 1

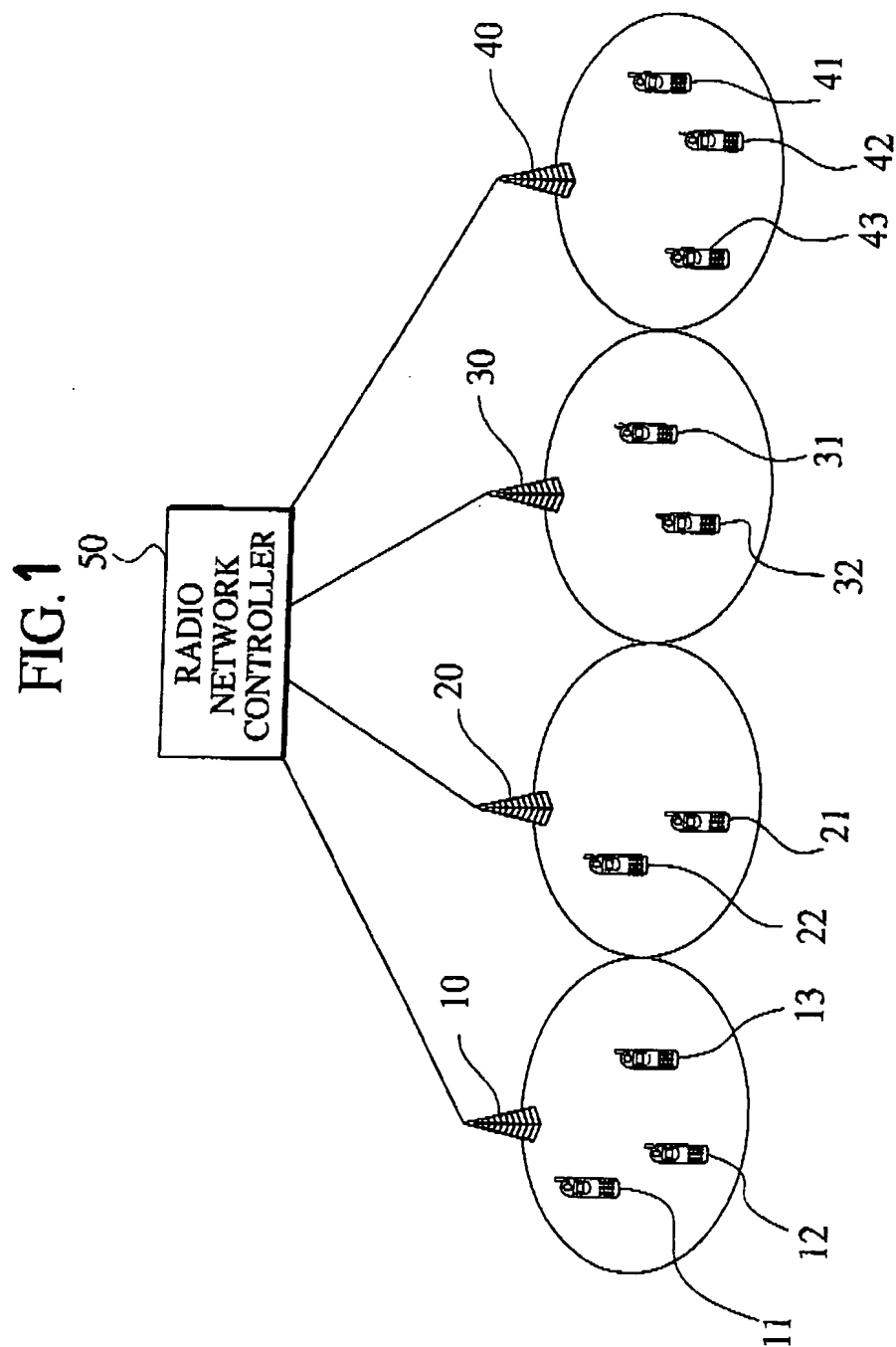


FIG. 2

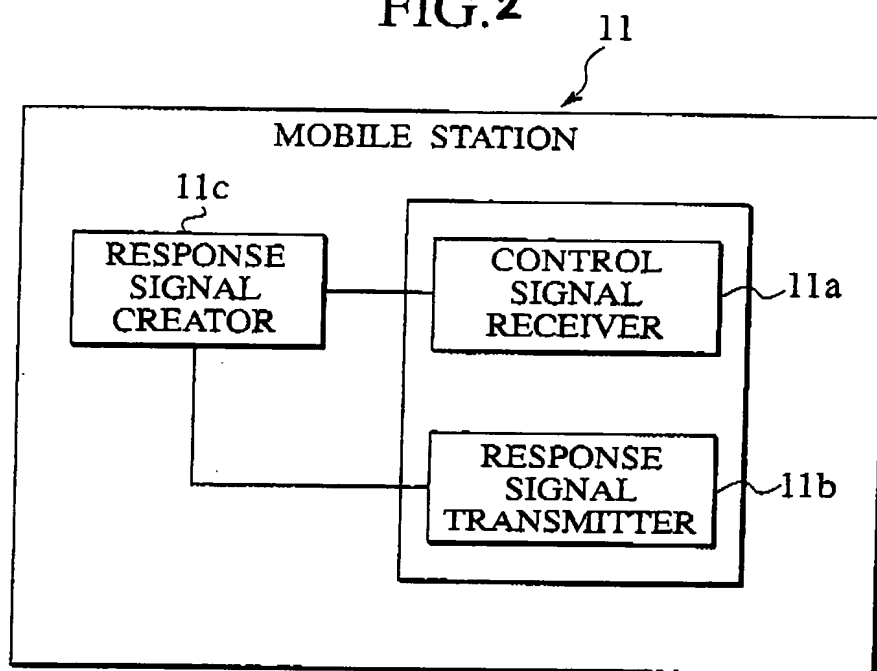


FIG. 3

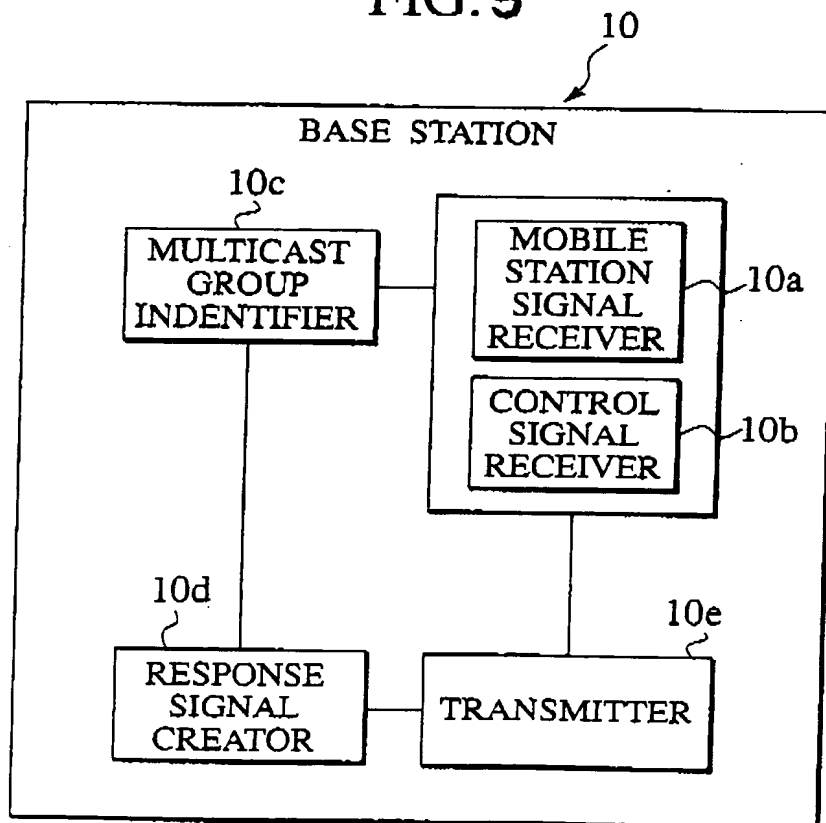


FIG.4

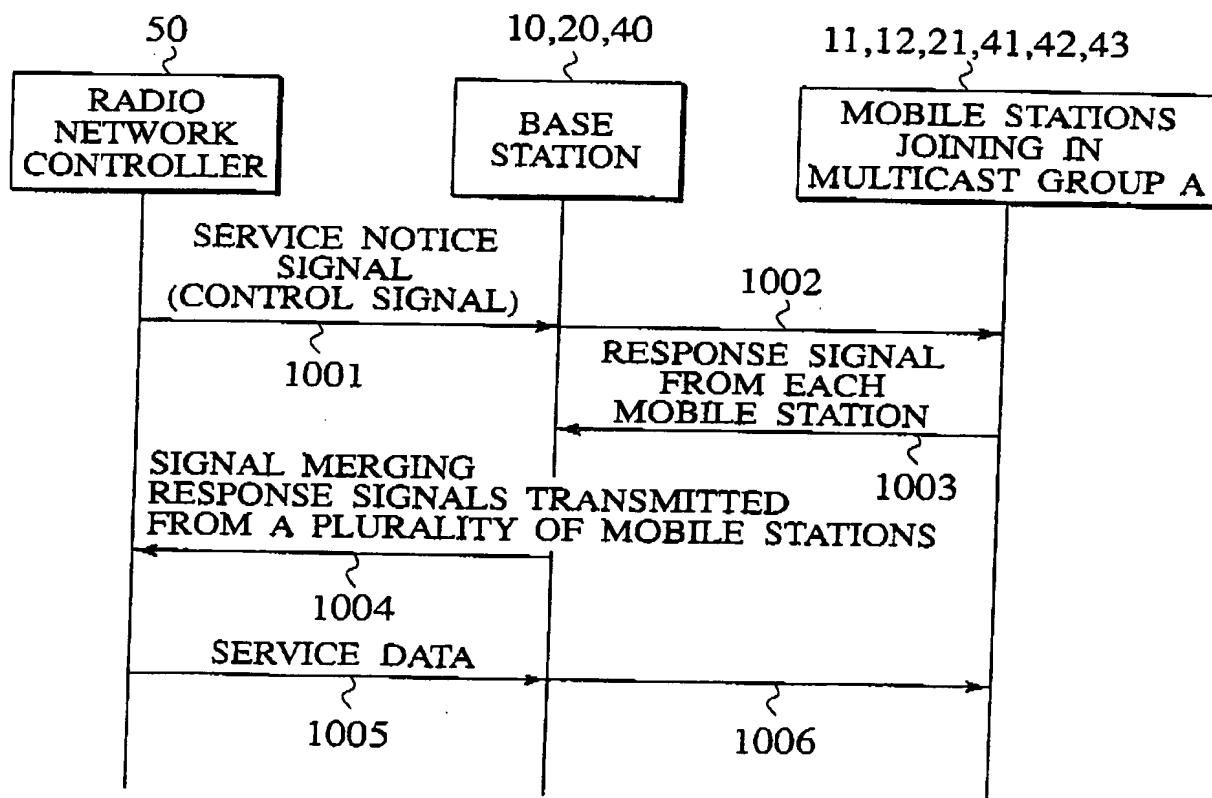


FIG. 5

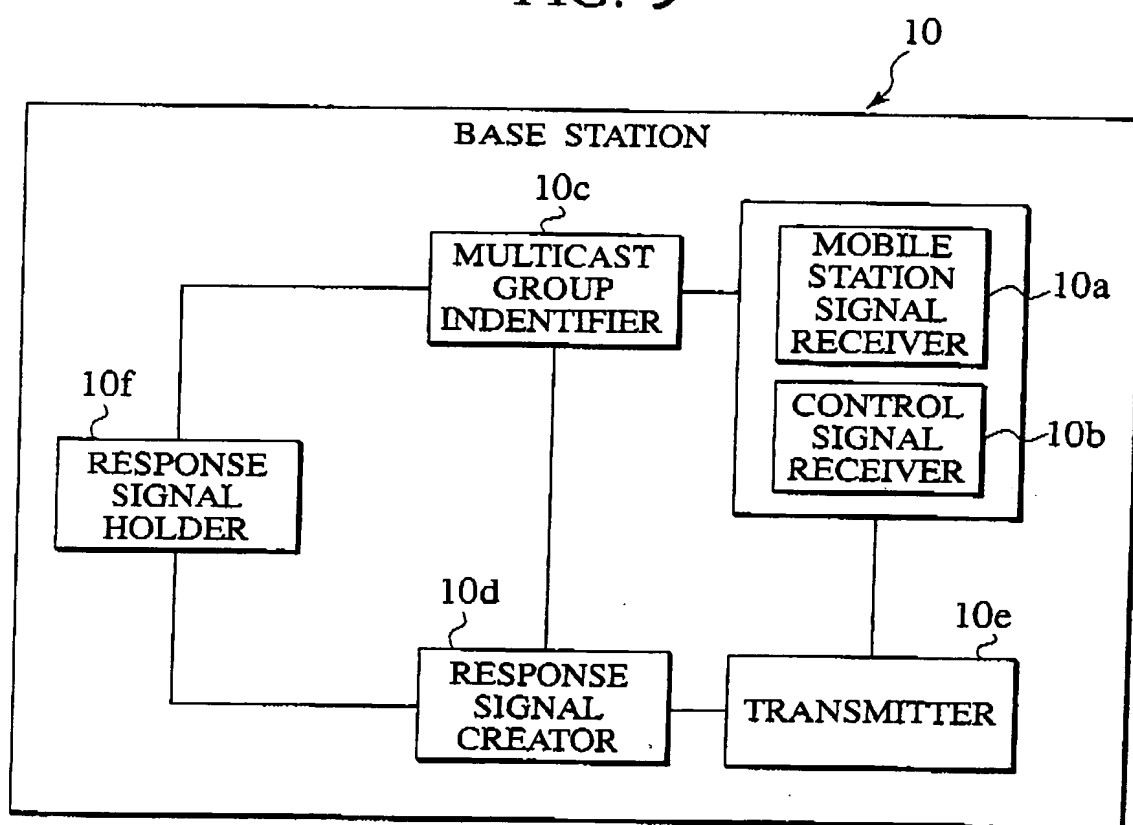


FIG. 6

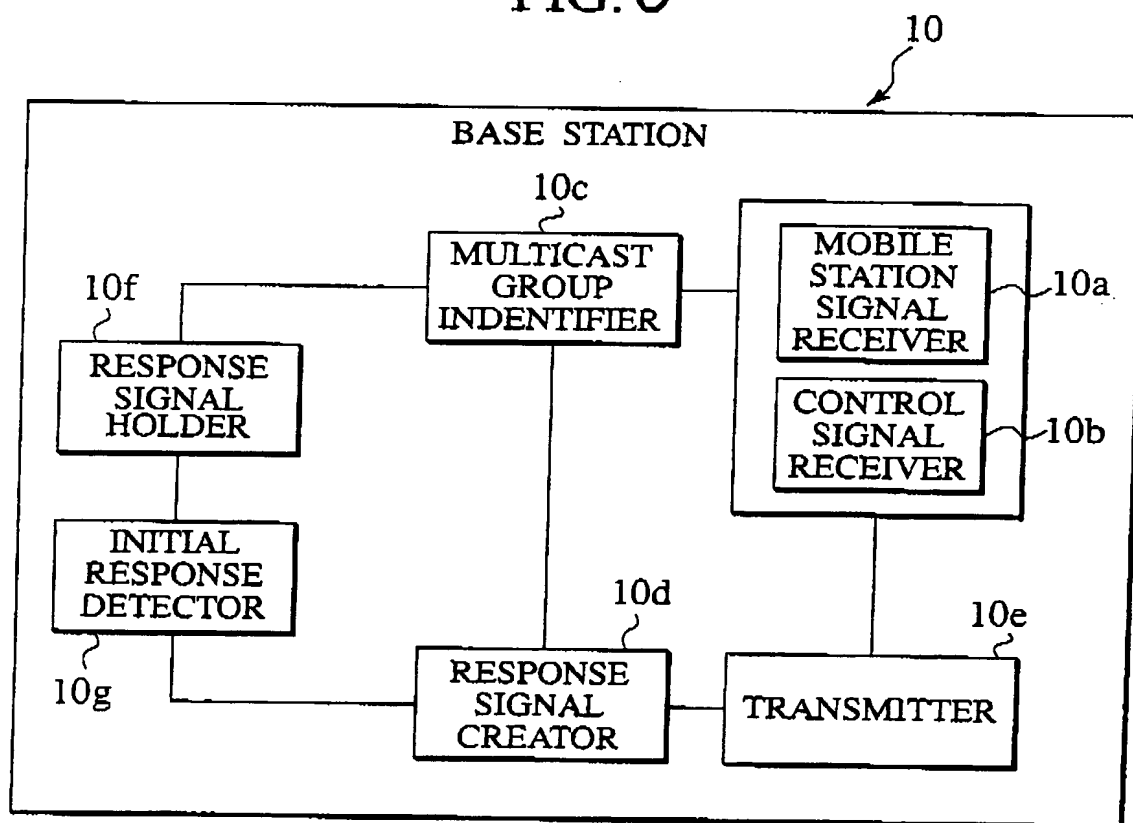


FIG. 7

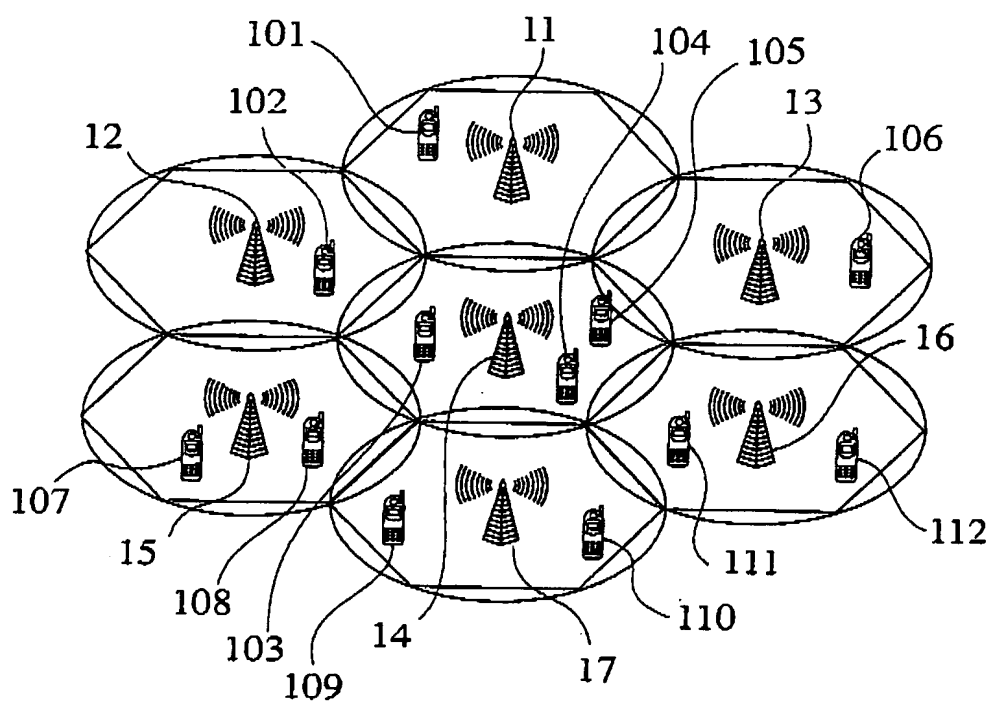


FIG. 8

